

# NASA TECH BRIEF

## *Lewis Research Center*



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### Advanced High-Temperature Electromagnetic Pump

A three-phase helical, electromagnetic induction pump, designed for use as the boiler-feed pump in a potassium Rankin-cycle power system, provides up to 1.5 kg/sec. (3.25 lb/sec) of 540°C (1000°F) potassium, at a pressure of  $1.66 \times 10^6$  N/m<sup>2</sup> (240 psi). The maximum pumping efficiency, developed at rated output, is 15.3 percent. The pump has also been operated successfully, without cavitating, at a net positive suction head (NPSH) as low as  $10.4 \times 10^3$  N/m<sup>2</sup> (1.5 psi).

The pump, designed for flight applications, is compact, lightweight, and highly efficient. Its overall length and diameter are 89 cm and 28 cm (35 in. and 11 in.), respectively. Though the 196 kg (431 lbs) weight of the pump, including instrumentation, is one fifth that of previous electromagnetic pumps of the same rating, pumping efficiency is greater by a factor of three.

The design of the pump requires the use of newly developed techniques for winding, insulating, sealing, and brazing the stator coils. The helical duct is fabricated from T-111 refractory alloy. The windings are made of nickel-clad silver wire, with high-purity alumina slot insulation. Sodium-potassium eutectic (NaK) at 425°C (800°F) is used as the coolant. The pump has successfully completed a 10,000 hour endurance at its design conditions.

#### Notes:

1. The following documentation may be obtained from:  
National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.95)

Reference: NASA CR-1949 (N72-21479), Fabrication and Test of a Space Power Boiler Feed Electromagnetic Pump, Part I -- Design and Manufacture of Pump

Reference: NASA CR-1950 (N72-17457), Fabrication and Test of a Space Power Boiler Feed Electromagnetic Pump, Part II -- Test Facility and Performance Test

Reference: NASA CR-1951 (N72-18493), Fabrication and Test of a Space Power Boiler Feed Electromagnetic Pump, Part III -- Endurance and Final Performance Tests

2. Technical questions may be directed to:  
Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B72-10537

#### Patent status:

NASA has decided not to apply for a patent.

Source: J. W. Gahan and A. H. Powell of  
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